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3,060,075

METHOD AND APPARATUS FOR PRODUCING CONTINUOUS BAG STOCK

Filed July 14, 1960

3 Sheets-Sheet 1

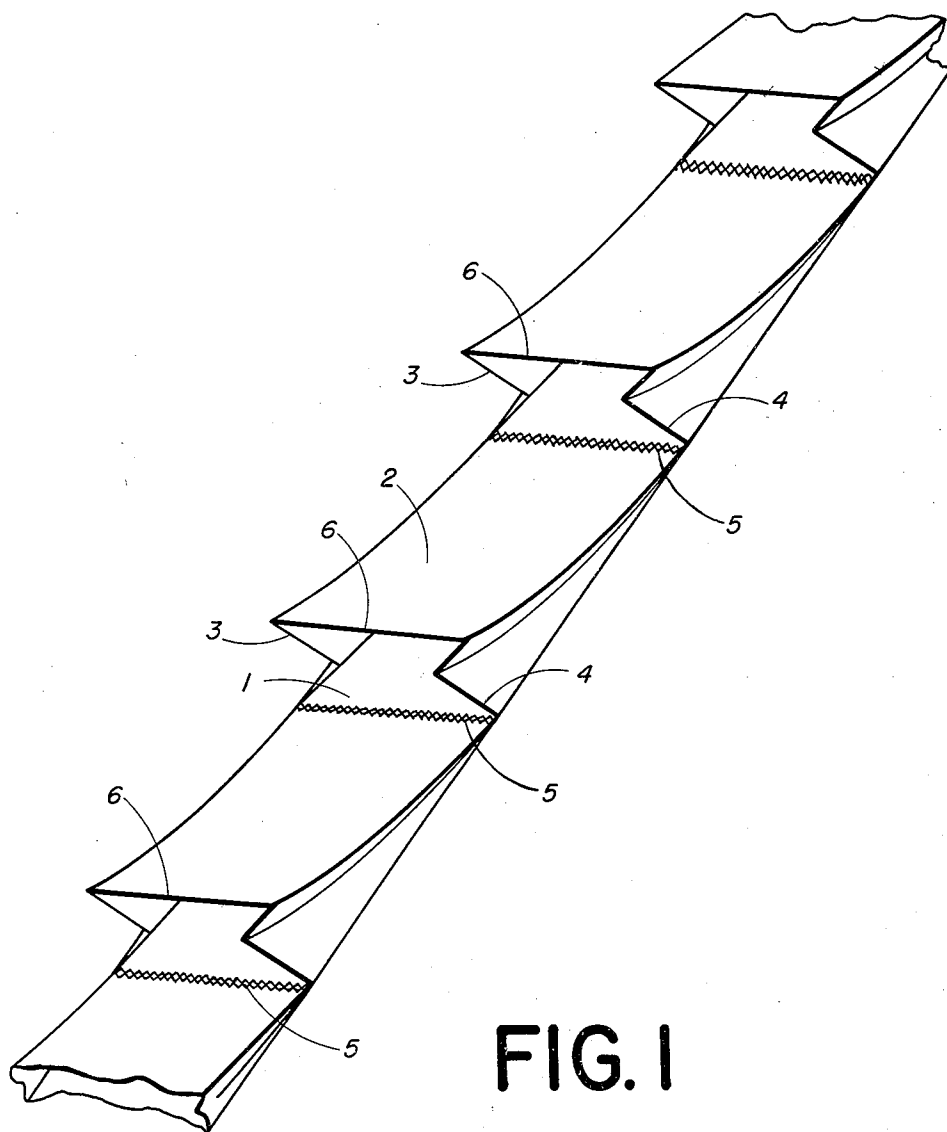


FIG. 1

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3 Sheets-Sheet 2

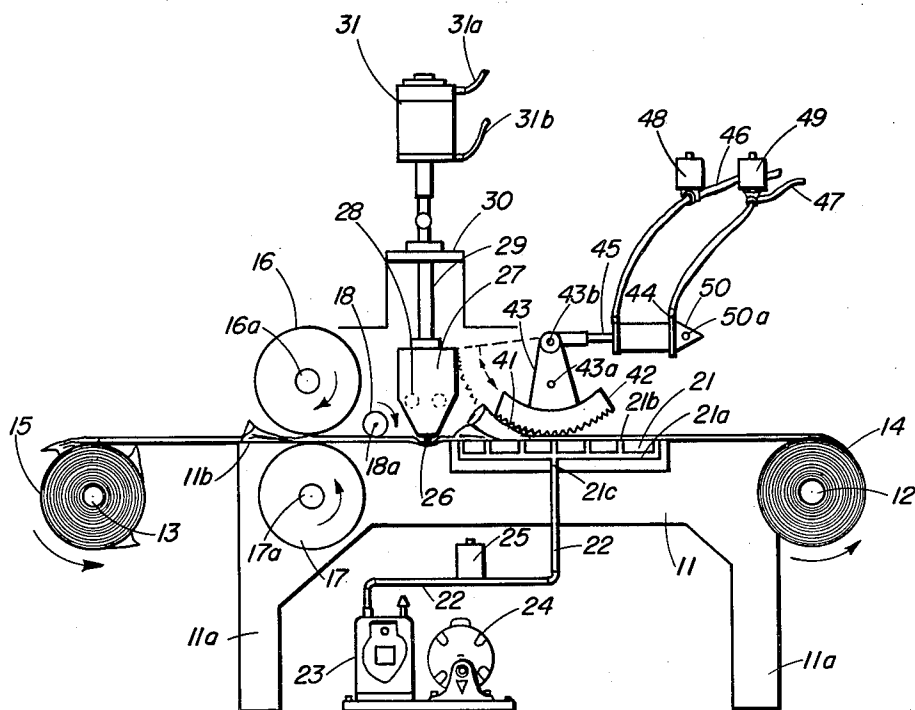


FIG. 2

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3 Sheets-Sheet 3

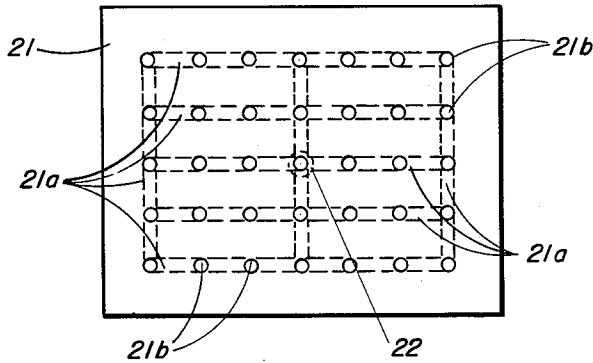


FIG. 3

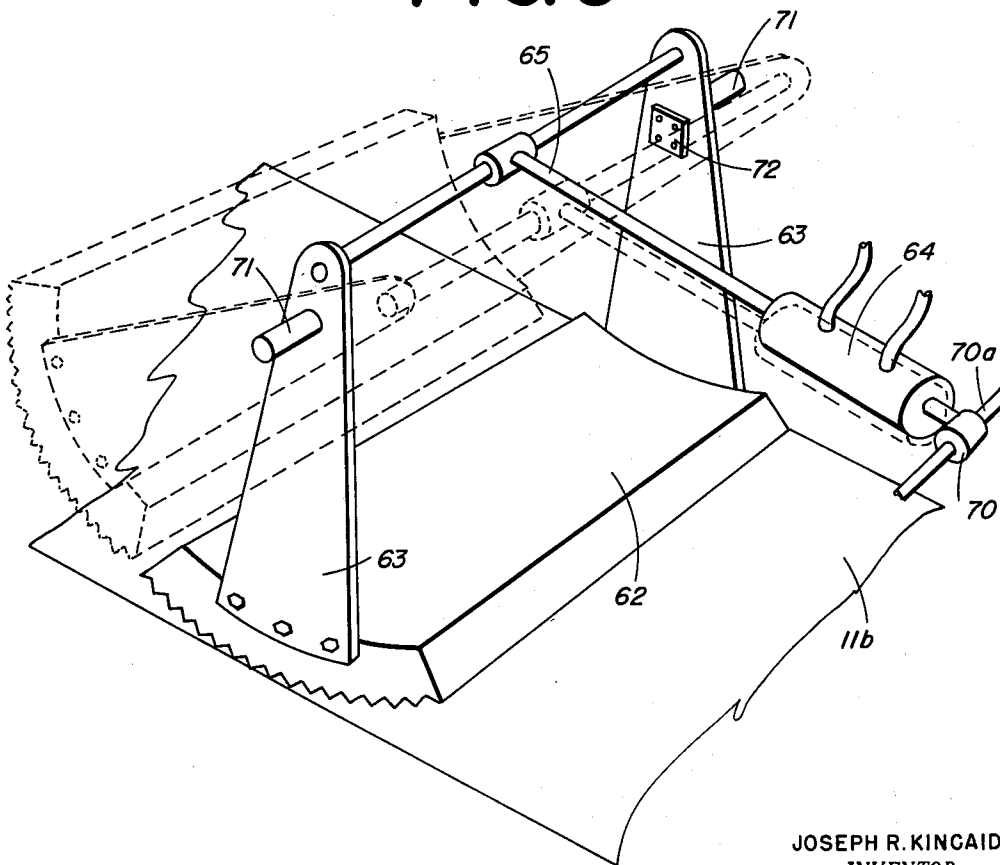


FIG. 4

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METHOD AND APPARATUS FOR PRODUCING CONTINUOUS BAG STOCK

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10 Claims. (Cl. 156-251)

The present invention relates to a method and apparatus for producing a continuous series of packaging bags from a tubular film of a thermoplastic material. More particularly this method and apparatus is concerned with the production of such series of bags from a gusseted tubular film, wherein the series of bags are joined one to another by transverse bottom seal areas, while providing open bag ends substantially along the lines of individual bag end seals. The invention further relates to such a series connected packaging bag product wherein individual bag units may be filled continuously, and subsequently separated one from another.

In conventional packaging operations, thermoplastic bags are filled as individual units. Such operation has been enforced by the fact that, until now, no practical way has been devised to produce a continuous series of bag units which may be fed through packaging equipment with minimum difficulty, and with increased speed, ease of handling, and reduced cost. Previous attempts to produce a continuous roll of preformed bag units have been stymied by the fact that, for this purpose, the bottom seal between bag units must be broken to provide a bag unit top opening. The present invention provides the method and means for providing a continuous roll film of bag units wherein the individual units are sealed at one end and open at the other.

It is an object of the present invention to provide for a continuous roll of tubular thermoplastic film wherein are defined a connected series of individual bag units. It is a particular object of the present invention to define a method and apparatus whereby a continuous film of tubular film may be divisibly and transversely sealed, while simultaneously separating said tubular film, along transverse seal lines, into a connected series of individual bag units.

The invention and its objects may be more fully understood from the following description, when it is read in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of the product contemplated by the present invention;

FIG. 2 is a schematic view, in side elevation, and partly in section, of the apparatus whereby the product according to FIG. 1 may be produced;

FIG. 3 is a plan view of the upper surface of a vacuum shoe plate as employed in the apparatus according to FIG. 2; and

FIG. 4 is a perspective view, partly in section of a typical bag forming element as employed in the structure of FIG. 2.

As illustrated by FIG. 1, the product is a continuous web of a thermoplastic material of originally tubular form. Generally this web is produced by extrusion from an annular die structure and passed through means whereby to produce opposed gussets immediately prior to passage of the web through nip rolls. The nip rolls flatten the web prior to being wound as a continuous roll of the plastic material. The formation of the original film web is a well known and conventional operation.

As shown in FIG. 1, the flattened web comprises two opposed web layers designated respectively by the numerals 1 and 2, the web layers being joined along their lateral edges through the medium of folded gussets 3 and

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4. In the finished product as shown in FIG. 1, the web is divided by seal lines 5 at intervals spaced longitudinally thereof. These seal lines are formed while sections of the upper web layer 2 are separated one from another, along such lines, by means such as shown by FIG. 2. The product formed is a series of bag units having a continuous lower web layer 1, sealed to the upper layer 2 laterally of the web at spaced intervals, as represented by seal lines 5. The upper layer 2 is separated from the lower layer 1 at similarly spaced intervals, designated by the numeral 6, to form a connected series of bag units wherein, when the units are separated by cutting along the seal lines 5, the separated edge 6 may be joined to the cut edge to form a closed bag.

The web continuity provided by means of the lower web layer 1 permits the bag units to be fed through a bagging machine in continuous fashion. As fed through the machine the bag units can be filled and sealed successively and at higher rates than when individual bags must be handled. As the continuous series of bags provided by the web proceeds through the bagging machine the free edge portions 6, including the gusseted side portions 3 and 4, are heat sealed to the underlying lower web layer 1 along lines substantially parallel to the seal lines 5. As a final step, the bag units may then be separated, one from another along the respective seal lines 5, by cutting or otherwise.

The apparatus for converting a gusseted and flattened tubular web into a connected series of bag units is illustrated schematically by the showing of FIG. 2. In this figure, the numeral 11 designates a support frame or table having leg portions 11a which support a top portion 11b, as well as providing support for other elements of the apparatus assembly by means not specifically shown, but of generally conventional nature, readily apparent to those skilled in the machine art.

Among those elements supported in conjunction with and in operating relationship to the table are a pair of roll shafts 12 and 13. These are supported, respectively, by means not shown, at opposite ends of the table 11 so as to extend in transverse relationship to the longitudinal axis of the table, and at a level below that of the table top, whereby to permit mounting of a roll of flattened tube stock on the shaft 12, and the receptive rolling of the finished bag product on the windup shaft 13, while providing for substantially flat surface contact with the table top intermediate the shafts. Where for reasons of space conservation, or where the tube stock is fed directly to the bag making machine from a web production source, the substantially flat surface contact may be obtained as by means of idler rolls mounted at each end of the machine at, or below, the end edges of the table. In the drawing, a roll of tube stock mounted on the shaft 12 is designated by the numeral 14, while the finished bag product wound on the shaft 13 is designated by the numeral 15.

The tube stock is drawn from the roll 14 by means of draw nip rolls 16 and 17. These rolls are mounted transversely of the table on shafts 16a and 17a, and supported, by means not shown, so as to make contact in a plane substantially common to that of the table top. Both the nip rolls 16 and 17 and the wind up shaft are driven by an intermittent drive means, not shown, so as to provide for indexed movement over the table top. Preferably the drive indexing means is adjustable so as to permit any desired determination of the bag length to be produced, and also so as to provide for any desired dwell time period between sequentially indexed movement of the web. In addition, immediately in advance of the nip rolls a static inducing, flap smoother roll 18 is supported transversely of the table top on its shaft 18a, by

means not shown. Preferably this roll 18 is disposed so as to make a brushing, frictional contact with the bag product, and is continuously driven. The direction of rotation of the several shafts and rolls, is indicated by directional arrows.

Intermediate the ends of the table, and supported thereby, with its upper surface disposed in the plane of the table top, is a vacuum shoe plate 21. This plate is illustrated in section by FIG. 2, and in plan view by FIG. 3. It comprises a cast or otherwise formed metal block which defines an interconnected series of conduit passageways 21a and 22b, wherein the passageways 21a are substantially parallel to the upper and lower plate surfaces, and the passageways 21b are in substantially right angular relation to the passageways 21a, and to the upper plate surface. Each of the passageways 21b is connected at its inner end in communicating relation with one or more of the passageways 21a, at their outer ends, the passageways 21b open through the upper surface of the shoe plate 21. The passageways 21a form an internal network of intercommunicating conduits connected in turn to a passageway 21c, opening outwardly through the lower surface of the plate. The conduit passageway 21c is adapted for connection, as by means of the pipe 22, to a vacuum pump 23, driven by the motor 24. A solenoid operated valve 25 in the pipe 22 is provided for controlled intermittent communication between the vacuum pump and the plate passageways.

Also mounted in the table top 11b, and transversely thereof is a seal pad 26. This pad is of a conventional nature well known in the art of heat sealing thermoplastics. It is disposed intermediate the shoe plate 21 and the smoother roll 18, and is adapted for operational cooperation with heat seal bar 27, mounted in an electrically heated head 28. The head 28, in turn, is mounted at the lower end of a plunger shaft 29.

The plunger shaft 29 extends upwardly from its connection with the head 28, through an annular guide plate 30, and thence into an air or hydraulic cylinder 31. The cylinder is served, as by means of conduit lines 31a and 31b, for reciprocal movement of the shaft head, and bar, whereby to press the bar against the tubular web of stock passed over the seal pad 26.

A distinctive feature of the apparatus contemplated according to the present invention, is the means provided for formation of the individual bag units while maintaining continuity of the tubular web, through its lower layer 1, as illustrated in FIG. 1. This means is a "break-open" shoe assembly designated by the numeral 41. The shoe assembly includes: a head portion 42; at least one radial support arm 43; shoe actuating cylinder and plunger shaft elements 44 and 45 respectively; and means such as fluid conduits 46 and 47 for supplying a fluid such as air to opposite sides of a piston head (not shown) disposed within the cylinder 44 and attached to the inner end of the plunger shaft 45. The numerals 48 and 49 respectively designate means such as solenoid valves for controlling fluid flow into the cylinder.

In this assembly, the shoe head 42 has an outer surface generally conforming to a minor arcuate section of a circle. Preferably the head has a length at least equal to the width of the tube stock to be passed through the apparatus and is disposed with its lengthwise dimension in transverse relation to the table top. The outer surface also may be formed or milled to include a series of serrations 42a extending longitudinally thereof. In any event, however, it is desired that the head outer surface be treated or coated with a friction inducing materials such as rubber, or a rubber-like material.

As shown in FIG. 2, the outer end of the single radial support arm 43 is integral with the head 42. Such construction is optional, and as shown in FIG. 4, two or more arms may be separate units, with the head and arms adapted for rigid junction to provide a unitary relationship. The support arm or arms, such as the arm 43,

should have a longitudinal dimension such as to provide two pivot points 43a and 43b centered on a line substantially midway of the arm edge portions, perpendicular to the outer face of the head 42, and midway of the longitudinal edges thereof. Of the two pivot points 43a and 43b, the point 43a is spaced from the outer surface of the head 42 at a distance equal to the radius of curvature thereof. The location of the pivot point 43b with reference to the head surface is not as critical as that of the point 43a, but should be spaced outwardly from the point 43a by a distance which will provide a sufficient lever arm distance for easy operating rotation of the support arm about the point or points 43a.

Pivotal means for mounting the support arm or arms, such as the arm 43, may be of any well known nature, including a single shaft mount, stub shafts, trunnions and the like. In FIG. 4, a pair of support arms are provided with separate stub shaft, pivotal mounting means.

Means for rotating the head 42 arcuately on the pivot point 43a is provided by the cylinder 44 and shaft 45. The cylinder 44 is provided with an outer end head portion 50 which is adapted for pivotal mounting at a pivot point 52a. The means provided may be a shaft extended through the head in transverse right angular relation to the longitudinal axis of the table. When so mounted it is contemplated that the plunger shaft 44 may be extended for pivotal connection to the support arm 43 at the pivot point 43b.

A typical break-open shoe assembly is illustrated in greater, enlarged detail in FIG. 4. As shown, a shoe head portion 62 is provided for support by means of a pair of support arms 63. These arms are attached respectively to opposite end edges of the shoe 62, as by means of stud bolts. Each arm is provided with a stub shaft 71 centered on a line parallel to the longitudinal axis of the head, and extending through the arms at pivot points spaced from the head outer surface by a dimension substantially equal to the radius of curvature of the head, in a manner as previously described with reference to FIG. 1.

The stub shafts as illustrated are provided with integral flange plates 72, the shafts being extended through suitable openings in the respective arms, and secured thereto by bolting the respective plates to an inner arm surfaces. Although not shown in the drawing, the shafts are adapted to be received in paired opposed trunnion bearings. These bearings are to be disposed and adapted to permit the head outer surface to be moved arcuately into substantially tangential relation to the plane of a table top such as that designated by the numeral 11b in FIG. 1.

A shaft or rod 74, centered on a line common to a pair of pivot points corresponding to the pivot point 43b of FIG. 2, provides means for attachment of one end of a plunger shaft 65. The other end of the shaft extends into an actuating cylinder 64, at one end thereof. The opposite end of the cylinder has a head portion including an eye bolt 70 adapted to receive a support shaft 70a, to provide a pivotal mount for the cylinder. In FIG. 4, the numerals 66 and 67 designate conduit connections corresponding to those designated by the numerals 46 and 47 in the apparatus illustrated in FIG. 2. In FIG. 4, the shoe 62 is shown in a position substantially as that of shoe 42 in FIG. 1, and as it would be after having separated the upper film layer along the transverse seal line 5 of FIG. 1. The initial position of the shoe, preceding the sealing step, is also shown in FIG. 4, by dotted lines.

In operation, referring especially to FIG. 1, the apparatus is first loaded. A roll of a gusseted, tubular film web 14 is placed on the shaft 12 and, with the shoe 42 elevated so as to clear the table top as in the manner illustrated by dotted lines in FIG. 4, the web 14 is led across the table top 11b, under the smoother roll 18, through the nip rolls 16 and 17, and engaged on a roll

center tube carried by the shaft 13. The apparatus is then ready for operation in the manner contemplated.

The first step in this operation is to open the valve 25, whereby to apply the vacuum of pump 23 to the passageways of plate 21, engaging the lower layer of the film web 14 against the upper surface of the plate under the pressure of the ambient atmosphere. Simultaneously, the valve 31 is actuated to engage the film between the seal bar 27 and the pad 26, the bar 27 having been brought up to a sealing temperature required for the particular film gauge and composition. Contact of the seal bar is timed to accomplish suitable fusion of the web layers and to establish the transverse seal line 5.

At the established moment of effective sealing of the layers, and while the seal bar still retains the web against the pad, the shoe assembly is actuated. This is accomplished by operation of the valves 48 and 49, whereby to extend the plunger shaft 45 from the cylinder 44. Extension of the shaft 45 acts upon the support arm 43 to rotate the arm on its pivot 43a, and thereby to move the shoe 42 arcuately downward into frictional engagement with the upper web layer. Continued rotation of the shoe, and the frictional engagement thereof with the upper web layer separates the layer substantially along the rearward line of the molten seal area. Arcuate movement of the shoe 42 is regulated, by timed action of the solenoid valves 48 and 49, whereby to produce only the desired separation of the upper layer and the gusseted side portions.

At this point, the valve 31 is actuated to raise the head 28 and seal bar 27 from sealing contact with the film web. Simultaneously, the valves 48 and 49 are actuated to reverse the arcuate movement of the shoe 42, and return it to its initial elevated position, as shown by dotted lines in the illustration provided by FIG. 4. In being returned to its initial position, the shoe 42 tends to flatten the separated upper layer, returning it to a substantially lay-flat position.

As the shoe 42 is returned to its elevated position, and immediately after separation thereof from contact with the upper web surface, the valve 25 is actuated to break the vacuum originally applied to the lower web surface. At this time also, the nip roll and winding roll drives are indexed to move the web over the table top 11b for a distance previously determined as the desired bag length. The sealing, web layer separation, and indexing steps are then repeated successively by continued synchronous operation of the valves 25, 31, 49, and 48 in the order set forth above, with cooperative indexed operation of the nip rolls 16 and 17, and winding roll 13 respectively. The roll 18, is driven continuously during the several intermittent operations described. Being of a type designed to induce a static charge in the film web, and by reason of the indicated direction of its rotation, the separated edges of the upper web layer are further induced to assume a lay-flat position at the web passes between the nip rolls, where this position is substantially impressed on the finished product.

Each of the valves 25, 31, 49, and 48 as well as the indexing control for actuating the nip roll and winding roll drive means is connected into a timing system whereby the operation may be regulated in a synchronous fashion. Such means and systems are well known in the art, and form no essential part of the inventive concept according to the present disclosure.

In a typical operation of the character contemplated, thermoplastic materials having a gauge of from about .0005 to about .006 inch most usually provide the tube stock material. With materials in this gauge range the dwell time, during which the transverse sealing and break open steps are accomplished, customarily will be in the order of one second. However, neither the material nor the operating conditions are limited to such typical case. Heavier gauge web materials may be employed, but in such event the sealing and fusion dwell time interval

must be regulated and accommodated to the material gauge, as is known in the art.

What is claimed is:

1. A method of forming a continuous series of interconnected bag units from a flattened web of a thermoplastic material, wherein said web includes superposed upper and lower layers of said material united along their longitudinal edge portions, comprising moving said web along a travel path, and in a plane extending longitudinally of the web, in a repetitive series of timed movement and dwell time sequences; during each dwell time sequence, applying heat and pressure to said web along a line transversely thereof, whereby to fuse and unite said web layers along said line; simultaneously holding said lower layer against movement in any direction during said dwell time sequences; and while maintaining said fusion pressure and holding said lower web layer, moving said upper layer over said lower layer in a direction longitudinally of said web, and opposite to the direction of intermittent movement in said travel path.

2. A method according to claim 1, wherein said flattened web of a thermoplastic material is an extruded tubular web which includes flattened gusset portions disposed longitudinally of the web along its side edges, and wherein fusion and layer separation steps include said gussets.

3. A method according to claim 1, wherein said thermoplastic material is in the range of from about .0005 to about .006 gauge, and said dwell time sequence is in the order of one second.

4. An apparatus of the character described comprising, a support structure having a table-like top surface; means for passing a web of a thermoplastic material over said top surface in a repetitive series of timed movement and dwell time sequences; a vacuum shoe plate supported transversely of said support structure intermediate the ends, said plate having a lower surface, an upper surface disposed substantially in a plane common to said top surface, and a plurality of internally defined interconnected conduit passageways opening through said plate upper surface; means for producing a negative pressure in said passageways during said dwell time sequence, including a vacuum pump and a conduit connection between said pump and said passageways; a seal pad disposed transversely of said top surface in cooperative relation to a heat seal fusion bar suspended thereover, and next adjacent to said shoe plate in the direction of movement of said web over said top surface; means for moving said fusion bar reciprocally intermittently to engage said web against said pad during said dwell time sequence; a break-open shoe assembly having an arcuately formed head surface portion suspended for pivotal movement about a longitudinal axis transversely parallel to said shoe plate upper and said top surfaces, and at a distance therefrom substantially equal to the radius of curvature of said arcuately formed head surface, whereby to be moved into substantially tangential frictional engagement with a web upper surface above said plate; and means for controlled limited reciprocal rotation of said break-open shoe about said axis during said dwell time sequence.

5. An apparatus according to claim 4, wherein said means for moving said web over said table top surface comprises a driven web wind-up roll disposed adjacent said support structure, transversely and below said top surface thereof; and a pair of driven nip rolls disposed transversely of said support structure, and for substantially tangential, pressure contact in a plane common to said structure top surface.

6. An apparatus according to claim 4, wherein said means for producing a negative pressure in said shoe plate passageways includes a motorized valve in said conduit connection between said vacuum pump and plate passageways, and wherein said valve is adapted to establish communication through said conduit connection in a sequence substantially corresponding to said web dwell time sequence.

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7. An apparatus according to claim 4, wherein said means for moving said fusion bar reciprocally comprises a cylinder and a piston shaft having an inner head end in said cylinder, and an outer end attached to said bar, and means for controlled sequential admission of a pressurized fluid to said cylinder, whereby to apply said fluid pressure to alternate surfaces of said shaft head.

8. In an apparatus of the character described, including a support structure having a table-like top surface, and a vacuum shoe plate disposed transversely of said support and having a top surface portion disposed in a plane substantially common to that of said structure top surface, a break-open shoe assembly, comprising a head portion having an outer surface defined as a segment of a circle; at least one support arm joined to said head portion to extend outwardly therefrom substantially along the radius of curvature of said head portion outer surface which bisects said head portion, and for a distance substantially greater than said radius; a pivotal support for said head and arm wherein said support is centered on a line common to the center of curvature of said head portion, and means for rotating said head and said support arm arcuately about said support.

9. An apparatus according to claim 8, wherein said means for rotating said head and said arm about said support comprises an extension of said arm along said radius of curvature; a piston rod pivotally attached at one end to said arm extension; a closed cylinder adapted to receive the other end of said rod and a piston head thereon; means for pivotally supporting said cylinder at the other end thereof; and fluid conduit means in connected communication with said cylinder on opposite sides of said piston rod head; and valve means in each said conduit means for alternately establishing connection therethrough between a source of fluid pressure and said cylinder.

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10. In an apparatus of the character described, including a support structure having a table-like top surface, and a vacuum shoe plate disposed transversely of said support, and having a top surface portion disposed in a plane common to that of said structure top surface, a break-open shoe assembly, comprising a head portion having an outer surface defined as a segment of a right circular cylinder; means for supporting said head transversely of said structure top and vacuum shoe plate surfaces in substantially parallel and tangential relation thereto, including a pair of support arm elements rigidly joined to said head portion and extended therefrom along a radius of said cylinder, and for a distance substantially greater than said radius; pivotal support means for said head and arms centered on the center of curvature of said head outer surface and adapted to suspend said head by said arms in substantially tangential relation to said shoe plate surface; a rod connecting said support arms disposed in substantially parallel relation to said shoe head surface, and in spaced relation to a line through said center of curvature; and a means for moving said shoe head and arms arcuately, connected to said support arm connecting rod.

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